KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2013/2014 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

COMP 311: DESIGN AND ANALYSIS OF ALGORITHMS

DAY: THURSDAY **DATE: 10/04/2014**

TIME: 11.00 - 1.00 P.M. **STREAM: Y3S1**

INSTRUCTIONS:

- Attempt Question ONE and Any other TWO

QUESTION ONE (30 Marks)

a) The development of a dynamic-programming algorithm can be broken into a sequence of four steps. List and explain them. (4mks)

b) Explain any two reasons why we study algorithms performance (2mks)

c) Design an algorithm to test if a given integer is Even or Odd? (3mks)

d) Explain the Big O mathematical definition (2mks)

e) An algorithm can be described in three ways, Using examples explain them. (6mks)

f) Given unsorted array i.e. A[0],A[1]…A[n-1],A[n]. State the best, worse and average case analysis of Linear search (3mks)

g) Write a program in C++/JAVA to find the GCD of two numbers using Euclid's Algorithm (4mks)

h) Design the Prim's algorithm and state its running time complexity (4mks)

i) Using an example explain the term *Longest common Subsequence* (2mks)

QUESTION TWO (20 Marks)

a) Algorithms that use a similar problem-solving approach can be grouped together, Write short notes on the following classification of algorithms (Give examples in each case)

i. Backtracking algorithms (2mks)

ii. Dynamic programming algorithms (2mks)

iii. Greedy algorithms (2mks)

iv. Branch and bound algorithms (2mks)

v. Brute force algorithms (2mks)

vi. Randomized algorithms (2mks)

b) Explain the order of growth of the following

i) $4n^3 + n^2 + 2n$ (2mks)

ii) $5n^2 + 3n + 2\log n$ (2mks)

c) Describe the following Algorithms concepts

i. NP hard problems (2mks)

ii. Floyd algorithm (2mks)

QUESTION THREE (20 Marks)

a) i) A knapsack problem is given as below, Use Greedy by Weight, Benefit and profit density to determine the optimal Solution.

Capacity(C)=20

Number of items (N) =3

Weight (Wi) =18, 15, 10

Profit (Pi) =25, 24, 15 (6mks)

ii) What is 0/1 knapsack? (2mks)

b) i) Suppose you a given a six letter alphabet with character and frequency as below, Use Huffman algorithm to develop a Huffman tree (4mks)

Character	a	B	C	d	E	f
Frequency	45%	13%	12%	16%	9%	5%

ii) State the code word for each character (4mks)

iii) Determine the running time complexity for Huffman algorithm (4mks)

QUESTION FOUR (20 Marks)

a) Given the Matrix Chain multiplication problem as below

B= 3x 100

C= 100x 5

D= 5x5

Determine the number of operations for the following parenthesized chain

i) (BxC)xD (2mks)

ii) Bx(CxD) (2mks)

b) Explain any two real world applications of Prims Algorithm (4mks)

c) i) Compare exchange sort and insertion sort algorithms (4mks)

ii) Determine the worse case running time complexity for c(i) above (4mks)

d) Using an example describe Dijkstra algorithm (4mks)

QUESTION FIVE (20 Marks)

a) Using an example explain the Karatsuba algorithm (4mks)

b) i) Design Kruskal's algorithm (4mks)

ii) State and explain the time complexity for Kruskal's algorithm (4mks)

c) Explain the Hamiltonian cycle TSP problem (4mks)

d) Design an algorithm and a flow chart to find the roots of a quadratic equation (4mks)